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A NEW FROZEN AVOCADO PRODUCT

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A frozen avocado product with keeping qualities suitable for commercial handling and distribution in frozen food lockers and cabinets has been developed by modification of existing household recipes for preparing the avocado spread called "guacamole". The modifications require increasing the acidity to about pH 4.5 by the addition of larger amounts of lemon or lime juice, and the addition of extra salt. The more acid product retains its light green color and desirable avocado-like flavor in frozen storage (0 to -10°F.) for periods of at least a year. A convenient container for marketing and use of this frozen product has been found to be collapsible metal tubes, although cans, jars, and waxed fiber cups can be used.

Bureau of Agricultural and Industrial Chemistry
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The avocado, Persea americana (Miller), is not produced in this country in oversupply at present; however, yearly increases in plantings are being made and surpluses may occur in the near future. It is desirable, therefore, to develop new processed avocado products which not only may add to the variety of the American diet, but may serve also as outlets for surplus and cull fruit.

Attempts have been made to preserve avocado slices and halves by methods such as heating and freezing. These attempts were never successful because of extreme ease and rapidity with which the tissues of the fruit turn brown on exposure to air or during heating. Avocado products, such as sandwich spread and salad dressing mixtures, as well as avocado slices and halves preserved by pickling, have been marketed in small quantities. Studies on various processes for food utilization of avocado have been conducted by the University of California and other research institutions and are reviewed by Cruess, Gibson, and Brekke in The Canner, 112(2):11, January 13, 1951, and (3):14, January 20, 1951.

A popular avocado spread called "guacamole" is made, according to household recipes, from pureed avocados, salt, onion powder, and lemon or lime juice. This spread retains to a high degree the desirable, unique flavor of the avocado, but it turns brown in four to eight hours after preparation, even when stored in the home refrigerator. Experiments have been conducted to improve the color retention of this product by varying the proportions of ingredients employed in the recipe. In this manner a formula has been developed for preparing an avocado paste which retains its attractive green color without darkening for at least a year in frozen storage, and for one to two weeks after thawing and storage at refrigerator temperatures. This has been accomplished primarily by adding larger proportions of lemon or lime juice and salt to the avocado puree. Avocado paste can be manufactured from overripe or second-grade fruit, and when prepared and handled according to the following directions, a desirable product, suitable for distribution as a frozen food item, is obtained.

Preparation and Packaging

The method developed for the preparation of frozen avocado paste is comparatively simple. Sound, ripe fruit is thoroughly washed, preferably with a good detergent, and rinsed well with cold water so as to reduce microbial contamination to a minimum. The fruit is pared and all discolored spots, damaged portions, and the seed are removed. The fruit is then pureed by sieving or passing through a food grinder. Sieving gives a smoother textured product, but many persons prefer the coarser texture produced from grinding. The avocado puree is then mixed with lemon or lime juice, salt and onion powder in the following proportions (by weight):

Avocado puree	100 parts
Lemon or lime juice	8.0 to 10.0 parts 1/
Salt (sodium chloride)	1.0 to 2.0 parts 1/
Dehydrated onion powder	0.3 parts 2/

The ingredients are blended and the finished product filled into a suitable container and frozen at 0° to -10° F.

Glass, enamel-lined tin, plastic and wax-impregnated fiber containers are suitable for packaging the avocado spread. However, the most novel and convenient type of container for the product is a collapsible aluminum or tin tube. With this type of container, the withdrawal of small portions of the thawed product as consumed leaves no head space for contact with air which might accelerate discoloration. Avocado paste prepared and packaged as described has been found to retain satisfactory color and flavor after storage for one year at 0° to -10° F.

Discussion of Formula

The formula herein presented was arrived at after observation of color retention during storage of avocado pastes made with widely varied proportions of lemon juice and salt. The increase in the acidity of the product caused by the addition of lemon juice appears to be the main contributing factor in color retention. However, larger amounts of lemon juice cause the flavor of the product to be too tart, and the recommended formula represents, therefore, the minimum amounts of lemon juice which will preserve the color without introducing more tartness than would be tolerated. The acidity obtained by the addition of lemon juice is about pH 4.5, which can be used as a standard. In order to standardize the acidity of the product it is necessary to base the quantity of lemon juice to be added on laboratory determinations.

Attempts were made to produce avocado paste in which citric acid was substituted for lemon juice. The flavor of the product was less desirable and color retention was not as good. No doubt the ascorbic acid contained in the lemon juice contributed to the prevention of browning. The application of mixtures of ascorbic acid and citric acid comparable to the amounts of lemon juice employed was studied, but again the flavor of the product was less desirable and color retention was inferior to that produced by the addition of lemon juice. Results also indicated that the amount of salt added was a factor in color retention, perhaps by reducing

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1/ These values represent the permissible range in the present formula for satisfactory retention of color for six months or more in the frozen state and for one to two weeks at refrigerator temperatures.

2/ Quantity may be varied according to taste, or the onion powder may be omitted if desired. Garlic powder may be used to vary the flavor of the product.

the solubility of oxygen in the mixture. In general, smaller amounts of lemon juice can be employed for color retention when larger amounts of salt are used, and the salt also tends to mask the tartness introduced by lemon juice. The causes of darkening have not been studied in detail, but from the considerations mentioned above it appears that darkening may be in part enzymatic and in part due to reaction of substances in the avocado with oxygen in the air.

When lime juice is employed instead of lemon juice, the amount added should be sufficient to bring the mixture to pH 4.5 for the preservation of the green color. Freshly ground onions or garlic, or onion or garlic juice can be employed instead of the dehydrated products if desired. In general, within the limits presented, the formula may be adjusted according to individual preferences. The product will retain a good color for at least a year at 0° to -10° F. storage, and for one to two weeks after thawing if stored at ordinary household refrigerator temperatures.

Uses of Avocado Paste

Avocado paste (guacamole) is primarily useful as a spread to be used with canapes, potato chips, or crackers. A tube of frozen avocado paste kept in the freezer compartment of the home refrigerator would be helpful to the housewife faced with the sudden problem of arranging "snacks" for unexpected guests. Simply thaw the tube in running water for a few minutes and serve on crackers or potato chips along with some favorite beverage. If a tube of the product is not consumed at once, it will keep in the regular food compartment of the refrigerator for one or two weeks' until used. In addition, the avocado paste can be mixed with mayonnaise, sour cream, or other dressing to add a refreshingly new flavor to salads.

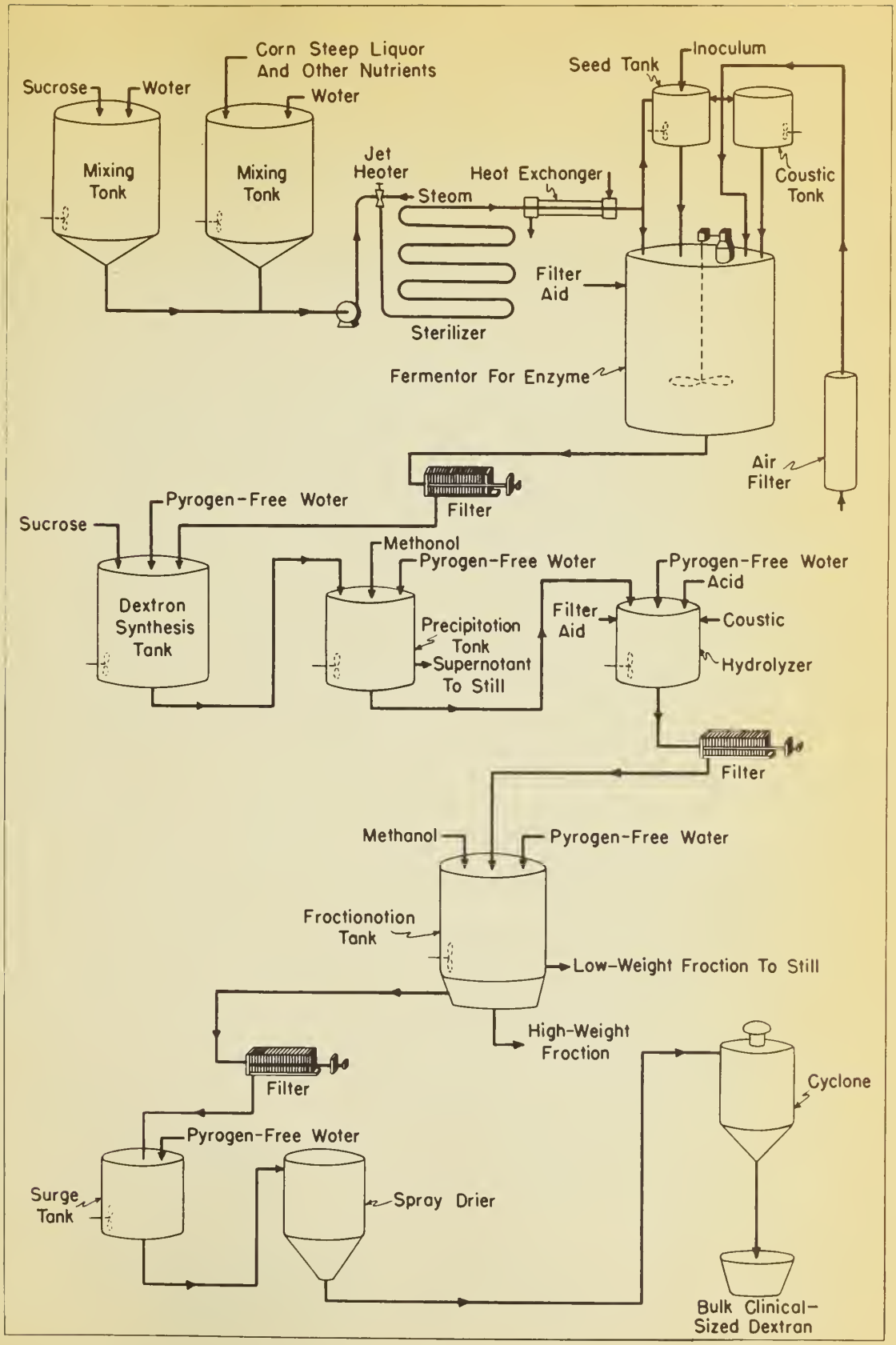

FIGURE 3. Flow Sheet for Production of Clinicol-sized Dextron by Enzymotic Synthesis and Acid Hydrolysis